NATIONAL MARINE SANCTUARIES™

Biogeography of the National Marine Sanctuaries

January 2003

A Partnership between the
National Marine Sanctuary Program and the
National Centers for Coastal Ocean Science

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Service
National Centers for Coastal Ocean Science & National Marine Sanctuary Program

Introduction

The mission of NOAA's National Marine Sanctuary Program (NMSP) is to serve as the trustee for a system of marine protected areas, to conserve, protect, and enhance their biodiversity, ecological integrity, and cultural legacy. Since 1972, thirteen National Marine Sanctuaries, representing a wide variety of ocean environments, have been established, each with management goals tuned to their unique diversity. These goals may include restoration and rebuilding of habitats or ecosystems to their natural condition, monitoring and protecting already healthy areas, and public education and outreach programs to generate understanding about the Sanctuary's role as a coastal steward. While some human activities in these marine protected areas are regulated or prohibited, achieving compatibility between conservation objectives and among multiple uses such as research, monitoring, commercial, and recreational activities is central to the design of the Sanctuary system. Monitoring and managing this range of goals and activities requires an approach that integrates human use with ecology and geography. The science of biogeography can support these complex challenges to ensure successful stewardship of sanctuary resources.

NOAA's Biogeography Team (Biogeo), recognized leaders in this field, has the capability to provide the necessary analytical tools and skills to support the NMSP mission. As a program within the National Centers for Coastal Ocean Science (NCCOS), it is in Biogeo's mission to provide rigorous scientific support to the NMSP. One of NCCOS's primary objectives stated in their strategic plan is to bridge the gap between science and management. This document describes how the NCCOS approach to biogeographic analysis can improve sanctuary management. Further, it proposes a five year service and capacity building process during which Biogeo will assist in the development of a biogeographically based approach to resource management within the NMSP. Finally, an appendix to this document describes the current status of Biogeography Team activities at seven of the National Marine Sanctuaries. This emphasis on biogeography will provide a framework within which all NCCOS studies in the NMSP can be given a broader ecological context.

What is Biogeography?

To understand how the NMSP can benefit from implementing biogeographic approaches to management, it is necessary to first define "biogeography". A general definition of "biogeography" is: the study of spatial and temporal distributions of organisms and their habitats, and the historical and biological factors that produced them (Cox and Moore, 1993). The complexity of products from biogeographic analysis range from simple distribution maps for a single species or a particular habitat to more complex products that combine these simple data layers to create maps of biodiversity or habitat diversity (Monaco et al. 1992, Nelson and Monaco 2000, Kendall et al. 2001). More commonly however, biogeographic products are even more complex and integrate several biological and physical parameters at once. For example, biogeographic analysis often integrates environmental variables with knowledge of organisms' habitat preferences and physiological limitations (Rubec et al. 1998; Rubec et al. 1999; Brown et al. 2000). This can result in a type of biological "weather map" which is used to define the probability of encountering a certain type of organism in a given area (Monaco et al 1998, Monaco et al. 2001). Other analyses may integrate the distribution of multiple species with some anthropogenic influence to determine how the biotic community is being affected (Christensen et al. 1997; Livingston et al. 2000). Still other products may focus on the changes in distribution of organisms or habitats through time. For example, the displacement of a native species by exotics can be analyzed in time series to predict future impacts and develop containment strategies. Even the response of organisms to global warming and sea level rise can be predicted and used to examine longer term management scenarios. These integrated products provide information not only on *where* specific organisms and habitats may be found, but also on *why* they are present only in those locations and how their distribution will change through time.

Biogeographic studies may range in spatial scale from continental to individual watersheds, estuaries, or even smaller areas. A single study may encompass several spatial scales to understand the distances over which

ecosystem components interact, or they may focus on a single scale to identify the specific details of a particular organism's distribution or other system component. Biogeographic studies may also include a range of time scales which may resolve changes in habitat or species distribution on daily, monthly, seasonally, or even on much longer scales. The scale and resolution of biogeographic studies is often subject to logistical, financial, and technological limitations. Financial and personnel allocations determine the amount of time that can be spent in the field collecting fine-scale information. As a result, the final extent and detail of the biogeographic data used in any study is typically customized to carefully balance logistical constraints while meeting the specific issues and objectives relevant to that locality.

Through biogeographic analyses, it is possible to predict where, when, and why organism or habitat distributions may change as a result of gradual processes such as slow accumulation of pollutants or the effects of global warming, to rapid and extreme events such as hurricanes and oil spills (Lowery 1992; Livingston et al. 2000). Most notably, biogeographic approaches are central to spatial management issues such as those addressed in marine sanctuaries.

Application of Biogeographic Concepts to Aid Sanctuary Management

The system of National Marine Sanctuaries encompasses a mosaic of seascape components, oceanographic conditions, and geomorphological features that include coral reefs, kelp forests, whale migration corridors, deep sea canyons, and even underwater archeological sites. They range in spatial extent from one-quarter square mile in Fagatele Bay, American Samoa to over 5,300 square miles in Monterey Bay, California. Despite vastly different management objectives and seascape features, all Sanctuaries are responsible for managing spatial resources and activities. To properly manage these resources, Sanctuary staff requires a thorough understanding of their distribution relative to Sanctuary boundaries. The mission statement of the NMSP concisely states this emphasis on biogeography...

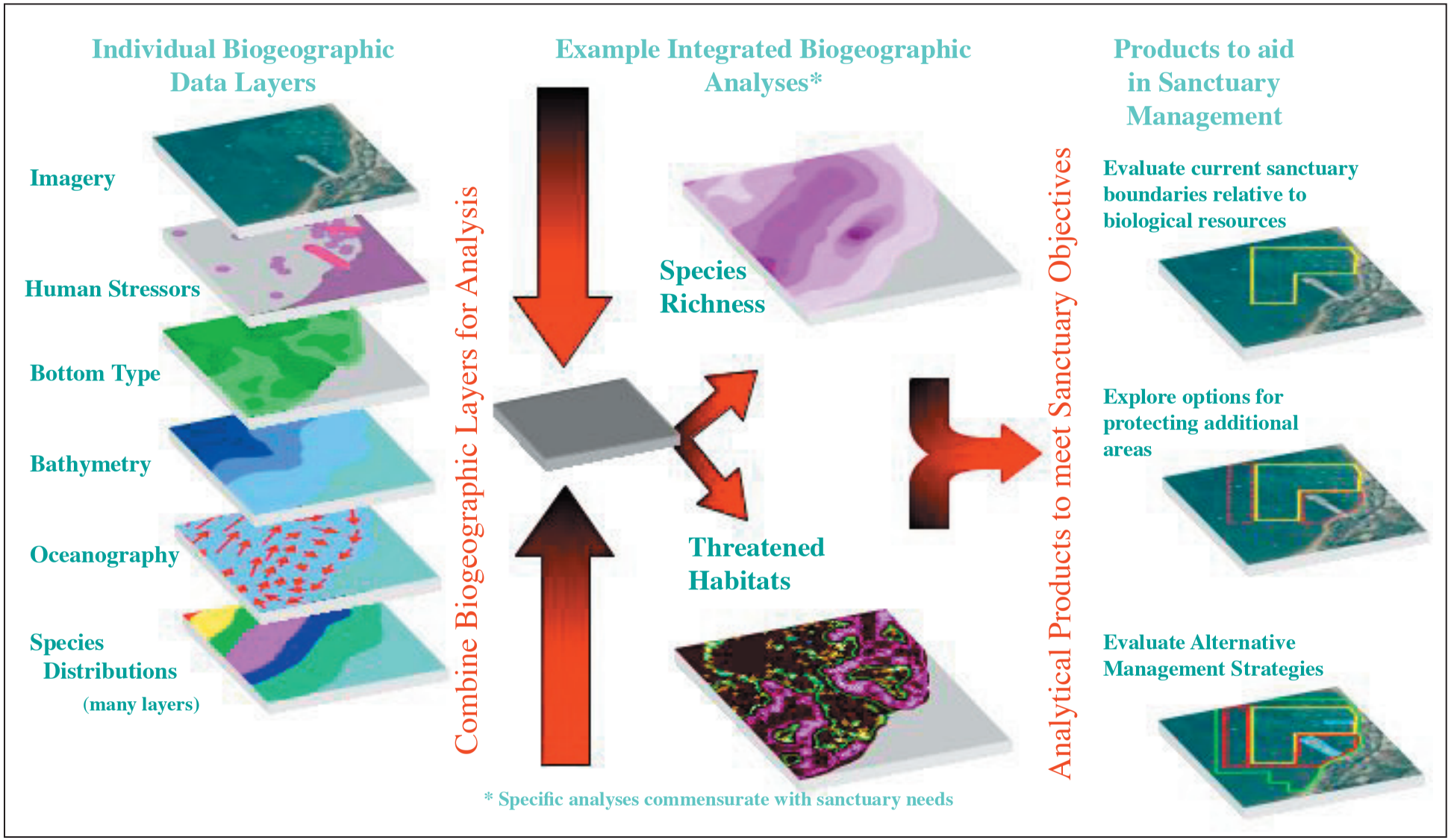
> *"The National Marine Sanctuary Program will serve as the trustee for the Nation's system of marine protected areas to conserve, protect, and enhance their biodiversity, ecological integrity, and cultural legacy."*

Biogeographic analysis is an ideal tool for Sanctuary managers to utilize for conservation of biodiversity and ecosystem integrity across the spectrum of spatial and time scales that these issues encompass. Even basic biogeographic data layers are lacking in many Sanctuaries, such as a simple inventory of organisms and habitat that the Sanctuary was designed to protect. Completing a biogeographic assessment of the distribution of such resources within and across Sanctuary boundaries is critical for placing them into their wider ecological context and to understand how the composition of the ecosystem changes through time. This baseline information is central to all management decisions and is the foundation for more sophisticated analyses. Coupling these simple data layers on the distribution of animals and their habitats with data on human and natural threats provides a powerful predictive tool for managers of those resources. Using the biogeographic approach, managers can explore the potential changes in resource

Biogeographic analysis is an ideal tool for Sanctuary managers to utilize for conservation of biodiversity and ecosystems across the spectrum of spatial and time scales that these issues encompass. *Biogeographic analysis allows managers to:*

- *evaluate current sanctuary boundaries relative to biological resources*
- *identify gaps in biogeographic data*
- *monitor changes in biological resources*
- *explore options for protecting additional areas*
- *evaluate alternative management strategies*

Figure 1: What Can a Biogeographic Approach do for Sanctuaries?



distribution that result from alternative management practices. Scenarios of interest may include, a better awareness of possible effects of an oil spill on sanctuary resources, understanding the impact of marine zoning within National Marine Sanctuaries or the alteration of current MPA boundaries or regulations governing the resources of a given sanctuary and the surrounding areas (Figure 1). The ability to conduct ecological forecasts across the range of spatial and temporal scales encountered by Sanctuary managers is a valuable asset when answering inquiries regarding the expected impact of proposed regulations, conveying the trade-offs in resource use among multiple interest groups, and in generating public support during the often contentious period of outreach that precedes changes in management practices (Scavia 2001).

A Focus on Diverse Management Needs

The goal of this five year effort is to bring a biogeographically based approach to the management of natural resources within the National Marine Sanctuaries. More specifically, this effort will be incorporated into the management plan review process for each applicable National Marine Sanctuary. Significant areas of this review process where biogeographic analysis can support information needs and decision making include: environmental characterizations, boundary evaluations, zoning, and threat assessment.

To successfully establish a biogeographic approach to management in the National Marine Sanctuaries, two objectives must be addressed. First, an assessment of current information holdings and a prioritized list of data needs must be completed for each Sanctuary. Second, for this assessment to have lasting benefits, the ability to repeatedly collect, manipulate, and analyze biogeographic data must be established at each site. This will be achieved by conducting a collaborative biogeographic study, bringing together the NMSP staff and Biogeo, to address a specific management issue at each Sanctuary. This will require the installation of suitable computer hardware and software, as well as placement of appropriately trained personnel at each site.

Advanced biogeographic approaches are already implemented to some degree at many sites and the national office, however, the capabilities of staff and equipment differ widely. Establishing a level of analytical expertise and hardware at each site that is commensurate with local and national needs is required to support the spatially explicit management approaches commonly used in biogeography and management of marine protected areas.

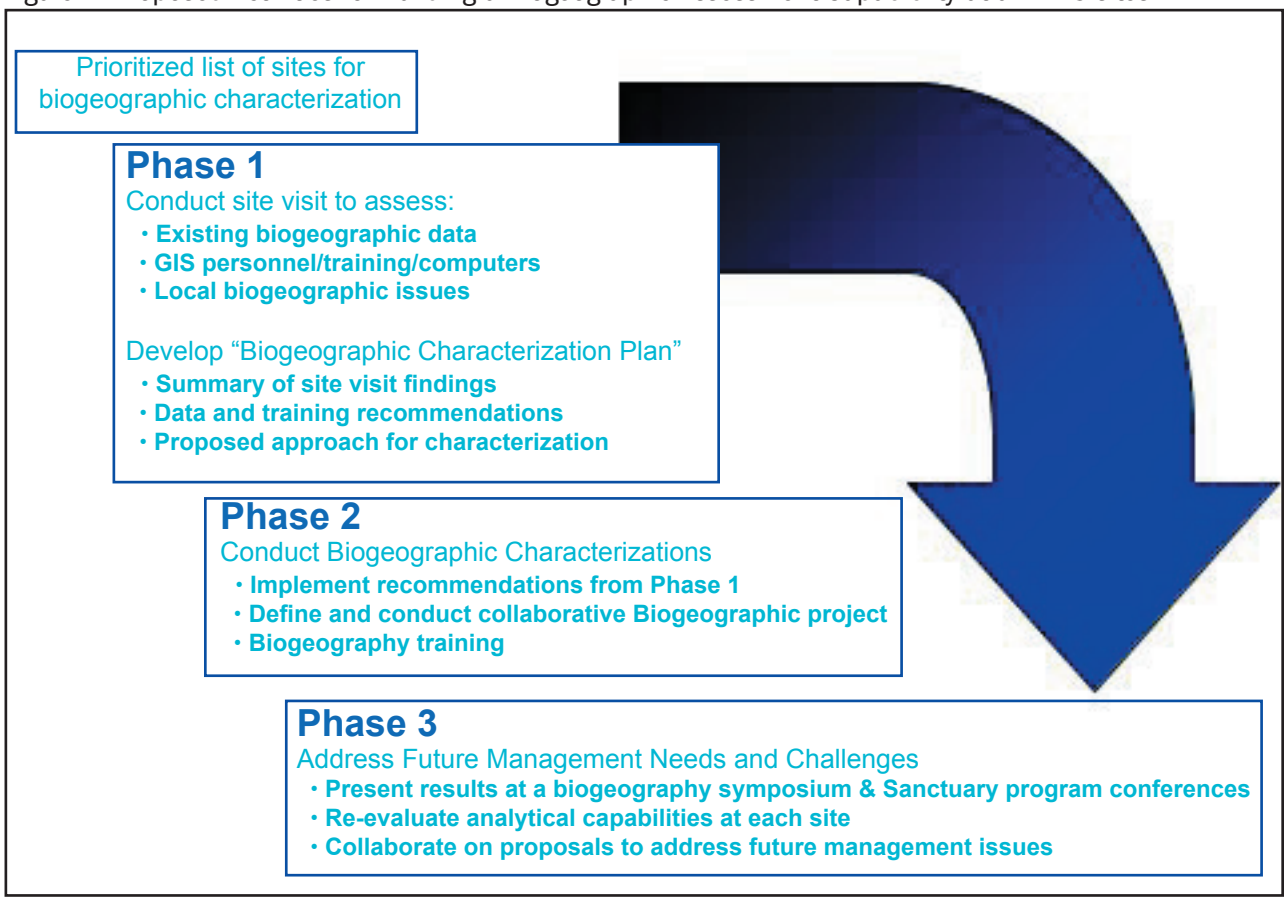
The Five Year Plan

Initially, Biogeo will work closely with the NMSP national office in Silver Spring, Maryland to define the overall approach (Figure 2). Over a period of five years, staff of Biogeo and the NMSP national office will work with each Sanctuary to address the objectives defined above. This work will be conducted in three phases: 1) developing a Biogeographic Characterization Plan, 2) conducting collaborative biogeographic characterizations, and 3) addressing future management needs and challenges.

Phase 1: Developing a Biogeographic Characterization Plan

Biogeo will begin by corresponding with each Sanctuary office to gather information on site capabilities and needs for conducting biogeographic assessments. These preliminary discussions will lead to site visits by Biogeo staff to Sanctuary offices. Activities at each site will include; discussion on the major resources, threats, and activities specific to the Sanctuary; field activities to enhance Biogeo's understanding of those specific biogeographic issues; and an assessment of the sanctuaries' current capabilities for performing biogeographic assessments. Findings from each site visit will be compiled into a "Biogeographic Characterization Plan" that will describe the strategy for meeting the Sanctuary's specific needs. The individual plans will include: 1) a description of the data, personnel, and hardware/software requirements for building local capabilities, 2) Biogeo's suggested approach for addressing the major issues confronting spatial analysis and biogeography at each site, and 3) an implementation plan for training and enhancing local personnel, data, and hardware for addressing biogeographic issues. A review and

Figure 2: Proposed Activities for Building a Biogeographic Assessment Capabiblity at all NMS sites



approval of the "Biogeographic Characterization Plan" with each Sanctuary and the NMSP national office will take place at the conclusion of Phase 1.

Phase 2: Conduct Collaborative Biogeographic Characterizations

During Phase 2, Biogeo will work with staff of each Sanctuary and the national office staff to define a collaborative project to be conducted at every Sanctuary. Projects will address a specific biogeographic issue for each Sanctuary and be derived from the discussion of specific Sanctuary needs identified during Phase 1. Each project will be detailed in scope and duration commensurate with the complexity of issue(s) being addressed at each Sanctuary.

Projects will be designed to meet three goals. First, a specific objective will be addressed to support a major biogeographic management issue. Second, Biogeo staff will work closely with Sanctuary staff to plan the analytical approach, conduct the biogeographic assessment or analysis, interpret the results, and compile the findings into a report. Finally, Biogeo will use the project as an opportunity to facilitiate the development and/or enhancement of NMSP capacity to conduct biogeographic analyses in the future.

In addition, opportunities for training in GIS, statistics, database management, biogeographic theory, and other subject areas requested by Sanctuary staff will be coordinated with current NMSP training opportunities. This may include formal coursework or a list of recommended readings or exercises. Since previous training and capabilities of staff from each Sanctuary are expected to vary, training opportunities will be suggested at several levels of complexity and tuned to meet local needs.

Phase 3: Addressing Future Management Needs and Challenges

In Phase 3 the remaining major biogeographic issues (i.e. those not addressed during the individual Sanctuary projects) for each Sanctuary that were identified during Phase 1 will be re-evaluated. Biogeo will work closely with the sanctuaries to devise an approach to confront these remaining issues given their new ability for conducting biogeographic analyses. This may include additional site visits and a re-evaluation of each sites' biogeographic assessment capabilities. Phase 3 will also involve continued Biogeo collaboration with specific sites on targeted issues. Where appropriate, all project reports will be prepared for publication in a peer reviewed journal once completed. The results of these completed projects will be presented at a "Biogeography Symposium" at a national scientific meeting (e.g. Conservation Biology, Landscape Ecology, Coastal Zone Management, etc.), and at relevant sanctuary program meetings and conferences.

Types of Products

· Hardcopy and electronic atlases showing the distribution of organisms and habitats
· Analytical products, such as, species assemblage maps or biodiversity metrics
· Internet accessibility for maps and raw data
· Mapping and analysis system(s)

Schedule of Activities

The order in which this work will be conducted in each Sanctuary will coincide, to the extent possible, with the Management Plan Review schedule and other existing projects at Sanctuary sites. Since the nature and complexity of the projects at each site are expected to vary widely and have not yet been defined, a specific schedule for Phases 2 and 3 cannot be produced at this time. However, Phase 1 will be initiated according to the following schedule:

FY03	Proposed Activities	Status
Monterey Bay, Gulf of the Farallones, Cordell Bank NMS	Biogeographic Characterization	Underway
Gray's Reef National Marine Sanctuary	Benthic Habitat Mapping	Underway
Fagatele Bay National Marine Sanctuary	Benthic Habitat Mapping	Underway
Northwest Hawaiian Islands Coral Reef Ecosystem Reserve	Ecosystem Monitoring Plan	Underway
Channel Islands National Marine Sanctuary	Defining Ecosystem Boundaries	Underway
Stellwagen Bank National Marine Sanctuary	MPR Support	Underway

FY04	Proposed Activities
Florida Keys National Marine Sanctuary	TBD
Flower Garden Banks National Marine Sanctuary	TBD
Hawaiian Islands Humpback Whale NMS	TBD
Monitor National Marine Sanctuary	TBD
Olympic Coast National Marine Sanctuary	TBD
Thunder Bay National Marine Sanctuary	TBD

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Comments/Questions

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Appendix A: Description of the status of current Biogeography Team projects at NMS Sites

Title: Benthic Mapping in Gray's Reef National Marine Sanctuary

Project Description:
Gray's Reef was designated as a National Marine Sanctuary in 1981 and encompasses a 17 square nautical mile area of sand and rock bottom located 17 miles off the coast of Georgia. It was selected as a Sanctuary in part due to the complex mosaic of habitats in the area including caves, scarps, and rocky overhangs which support a diverse assemblage of organisms including approximately 150 species of fish, 200 species of invertebrates, and 65 species of seaweed. Despite a wealth of investigations on the natural resources of the Gray's reef community and benthic features, a detailed baseline map of the distribution of major bottom types within the Sanctuary landscape has not yet been produced.

NOAA's National Marine Sanctuaries Program (NMSP) and specifically the Gray's Reef NMS have expressed interest in obtaining a baseline characterization of the benthic resources in the Gray's Reef area. Such an assessment is needed to support the many activities and responsibilities of Sanctuary Staff including natural resources management, education, research, and even for promoting responsible recreational use by fishermen and divers. An understanding of the distribution of benthic resources provides the spatial framework within which to conduct Sanctuary monitoring activities, identify and protect essential fish habitat, and properly address other spatially explicit research and management goals. This baseline characterization is also the first step in monitoring temporal changes in the Gray's Reef landscape and understanding more about the dynamic nature of this region of the continental shelf.

To meet this need, the NCCOS Biogeography Team is mapping benthic habitats of the Sanctuary using sonar imagery. Maps are being developed through combined analysis of multibeam bathymetry, sidescan backscatter, and video transects using custom GIS applications. Completed maps will include a number of unconsolidated sediment and hard bottom thematic categories.

Proposed Products: Digital maps for use in a Geographic Information System will be the primary product. Secondary products will include: field data used to guide map production, an assessment of classification accuracy, and a report on methods used to create the maps.

Status Beginning FY 2003: A draft classification scheme has been used to map a test area that includes ~5% of the Sanctuary. Based on the results of this test area, dives and video transects were conducted to provide ground validation data of representative sonar signatures in the entire project area. Remaining activities to complete project objectives are as follows:

Activity	Estimated Completion Date
Draft Benthic Map of GRNMS	2/01/03
Preliminary Assessment of Thematic Accuracy	2/01/03
Draft Project Report	2/15/03
Peer Review of Draft Map	2/15/03
Revised Map	3/01/03
Assessment of Thematic Accuracy of Final Map	3/01/03
Delivery of Final Map Product	3/15/03
Delivery of Final Project Report	3/15/03

Collaborators:

- Gray's Reef NMS
- Skidaway Institute Oceanography, GA
- NCCOS/CCFHR
- State of Georgia, Department of Natural Resources

Funding and Draft Spending Plan: FY 2003

Object Class	Annual Plan		QTR 1	QTR 2	QTR 3	QTR 4
Travel	20,000	=		5,000	5,000	10,000
Contractual Services	20,000	=			20,000	
Supplies & Materials	5,000	=				5,000
Equipment	10,000	=			5,000	5,000
TOTAL CY OBLIGATIONS	55,000	=	0	5,000	30,000	20,000

NCCOS Biogeography Team Contact:
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Title: A Biogeographic Assessment of Stellwagon Bank NMS

Project Description:
Stellwagon Bank was designated as a National Marine Sanctuary in 1992 and encompasses a 638 square nautical mile area of glacially deposited sand located between Cape Ann and Cape Cod off the coast of Boston, Massachusetts. The highly productive region has a long history of human exploitation and animal use due to a unique interplay between water currents and dramatic changes in bathymetry. Despite heavy direct use and nearby stressors, the Sanctuary continues to be home to a diverse assemblage of seabirds, whales, fish, and invertebrate species. A variety of directed studies have been conducted on the biota of this area, however, an integrated characterization of the regions biogeography has not been conducted.

NOAA's National Marine Sanctuaries Program (NMSP) and Stellwagon NMS are interested in obtaining a comprehensive biogeographic characterization of the biological and habitat resources within this region. This characterization is needed to support Sanctuary management and research activities given the complex range of user activities, direct, and indirect threats to the biota and habitats of the region.

To meet this need, the NCCOS Biogeography Team is undertaking a collaborative project to integrate the existing knowledge on habitat and biotic distributions within the Sanctuary into a comprehensive biogeographic assessment. This initial assessment will be used in conjunction with the priorities identified in the 2002 Information Needs Report to devise targeted biogeographic analyses.

Proposed Products: The initial product will be an integrated assessment of the biogeographic data and resources of the Stellwagon Bank NMS. Future analytical and data products will be devised following consideration of the existing data.

Status Beginning FY 2003: This project will be initiated in Nov 2002. A project proposal will be developed with SBNMS Staff in Spring 2003. The project will be completed in Jan 2004.

Collaborators:

- Stellwagon Bank NMS
- TBD

Funding and Draft Spending Plan: FY 2003

Object Class	Annual Plan		QTR 1	QTR 2	QTR 3	QTR 4
Travel	20,000	=	5,000	5,000	5,000	5,000
Contractual Services	40,000	=			40,000	
Supplies & Materials	5,000	=				5,000
Equipment	10,000	=			5,000	5,000
TOTAL CY OBLIGATIONS	75,000	=	5,000	5,000	50,000	15,000

NCCOS Biogeography Team Contact:
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Title: Biogeographic Assessment of Alternative Boundary Options for Channel Islands NMS.

Project Description:
Channel Islands NMS was designated as a Sanctuary in 1980 and encompasses a large area of rocky coastline, kelp beds, and sea floor located off the coast of southern California. The islands and surrounding waters were selected as a Sanctuary due to their unique geological formations, oceanographic characteristics, natural resources, and cultural significance. At the time of Sanctuary designation, its boundaries extended from mean high tide offshore to a distance of six nautical miles. This area was selected to provide adequate protection of the resource given the limited information on the spatial distribution of threats, uses, biota, and habitats that was available at the time.

NOAA's National Marine Sanctuaries Program (NMSP) is currently considering five alternatives for expanding Sanctuary boundaries. These alternative boundary options have not yet undergone consideration from a biogeographical perspective. Identifying how the five options overlay with the distribution of biotic and habitat resources is a critical component of assessing their effectiveness for meeting sanctuary objectives. Since the time of original designation, numerous field studies coupled with advancements in remote sensing have produced new spatial data that can be used to address these boundary options.

To meet this need, the NCCOS Biogeography Team is conducting a biogeographic characterization of the Channel Islands ecosystem in the context of the five proposed boundary modifications. The assessment will begin by gathering existing spatially explicit biological and environmental data. Data extent, quality, and position relative to alternative boundary options will be evaluated. Modeling, data integration, and quantitative assessment of biotic and habitat resources will be produced for each boundary scenario.

Proposed Products: The primary product will be a quantitative characterization of the distribution of organisms and habitats for each of the five proposed boundary modifications. A GIS of the currently available biogeographic data for the region will also be provided.

Status Beginning FY 2003: This project was initiated in November 2002. A project proposal will be developed with CINMS Staff in Spring 2003. The project is estimated to be completed in May 2004.

Activity	Estimated Completion Date
Initial Project Discussions	11/02

Collaborators:

- Channel Islands NMS
- TBD

Funding and Draft Spending Plan: FY 2003

Object Class	Annual Plan		QTR 1	QTR 2	QTR 3	QTR 4
Travel	35,000	=	10,000	10,000	5,000	10,000
Contractual Services	160,000	=		160,000		
Supplies & Materials	5,000	=				5,000
Equipment	5,000	=				5,000
TOTAL CY OBLIGATIONS	205,000	=	10,000	170,000	5,000	20,000

NCCOS Biogeography Team Contact:
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Title: Assist Development of Northwest Hawaiian Island Ecosystem Science Plan

Project Description:
The Northwest Hawaiian Islands Coral Reef Ecosystem Reserve was established in 2000. The region consists of a vast area of atolls, volcanic islands, seamounts, and open ocean areas that are home to a tremendous diversity of endemic and regional species of marine fauna. The area is a candidate for management under the National Marine Sanctuaries Program. Interim steps in the sanctuary designation process are needed including a comprehensive assessment of the state of existing scientific knowledge of the area.

NOAA's NMSP is working collaboratively with a number of federal and local partners to collect and integrate available scientific data for the region. This group will then create an appropriate Science Plan given the state of our current understanding of the region. The Science Plan will serve as a guide to Reserve/Sanctuary managers and researchers as the region is integrated into the NMSP.

The Biogeography Team will coordinate data reconnaissance, develop GIS assessments of available data, and facilitate development of the Science Plan.

Proposed Products: A GIS database of the existing spatially explicit data available for the Northwest Hawaiian Islands. This will include assessment of data extent, gaps, quality, temporal and spatial scope, and other parameters necessary for development of the science plan.

Status Beginning FY 2003: This project has just been initiated. The specific scope and goals of this project are currently under development.

Activity	Estimated Completion Date
Scoping Meetings	12/02
Data Reconnaissance	12/02
Data Assessment Workshop	2/03
Science Plan Recommendations	6/03

Collaborators:

- NMSP
- NOS
- NMFS
- State of Hawaii
- USFWS
- Bishop Museum

Funding and Draft Spending Plan: FY 2003

Object Class	Annual Plan		QTR 1	QTR 2	QTR 3	QTR 4
Travel	40,000	=	5,000	20,000	5,000	10,000
Printing & Reproduction	5,000	=				5,000
Contractual Services	10,000	=				10,000
Supplies & Materials	5,000	=				5,000
TOTAL CY OBLIGATIONS	60,000	=	5,000	20,000	5,000	30,000

NCCOS Biogeography Team Contact:
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Title: A Biogeographic Assessment of North/Central California National Marine Sanctuaries

Project Description:
Together the three north/central California sanctuaries: Cordell Bank (CBNMS), Gulf of the Farallones (GFNMS), and Monterey Bay (MBNMS) encompass a large area of the California coastline and continental shelf protecting an abundant variety of organisms and habitats. The seasonal upwelling of this area provides the foundation for one of the most productive marine ecosystems in the U.S.. These sanctuaries are currently in the process of jointly revising their sanctuary management plans which have not been updated for several years. Since the time these sanctuaries were designated the natural resources and management issues within the sanctuaries have changed significantly. In addition, major accomplishments in research and resource assessments have been made in recent years. It is important to incorporate this new and expanding knowledge base into the management plan revisions, specifically, incorporating a comprehensive biogeographic characterization of this region is required to develop successful sanctuary management plans.

NOAA's NMSP has requested that the NCCOS Biogeography Team support the management plan revisions by conducting a biogeographic assessment of marine waters off northern and central California explicitly ignoring the current Sanctuary boundaries. The assessment will instead identify important biological zones, time periods, and ecological linkages within an analysis area that will include the three national marine sanctuaries and adjacent waters extending from Point Arena in the north to Point Sal in the south.

The project will be completed in two phases including; 1) an initial biogeographic assessment focusing on offshore processes and ecology, and 2) a subsequent refinement of these offshore analyses along with a characterization of nearshore ecology.

Proposed Products: A summary report of the GIS analyses and results that identify important biological areas and time periods, based on species distributions, abundance, habitats, and their ecological function will be produced. In addition, the data sets used in these analyses will be organized into a Geographic Information System (GIS) and analysis tool to support future Sanctuary activities. Finally, a descriptive report on the ecological components, links, and processes of the estuarine and marine regions off north/central California will be produced.

Status Beginning FY 2003: Development of the ecological linkages report and the initial offshore biogeographical characterization is scheduled for completion early in FY-2003. Based on the results and comments on these products, a work plan for refining the offshore analyses and conducting the nearshore assessment will be developed. Activities to complete project objectives are as follows:

Activity	Estimated Completion Date
Phase I Final Product	5/03
Initiate Phase II Biogeographic Assessment	5/03
Final Ecological Linkages Report	1/03
Draft Work Plan for Phase II	7/03
Phase II Final Product	9/04

Major Collaborators:

- National Marine Sanctuary Program
- The three north/central California NMS offices
- NMFS
  - Southwest Fisheries Science Center
  - Northwest Fisheries Science Center
  - Alaska
- State of California/California Department of Fish and Game

- H.T. Harvey & Associates
- R.G. Ford Consulting Company
- University of California /Moss Landing Marine Lab
- Cascadia Research
- California State University
- Monterey Bay Aquarium Research Institute
- PRBO Conservation Science

Funding and Draft Spending Plan: FY 2003

Object Class	Annual Plan		QTR 1	QTR 2	QTR 3	QTR 4
Travel	25,000	=		10,000	5,000	10,000
Printing & Reproduction	15,000	=		5,000	5,000	5,000
Contractual Services	30,000	=		30,000		
Supplies & Materials	5,000	=				5,000
Equipment	5,000	=		5,000		
TOTAL CY OBLIGATIONS	80,000	=	0	50,000	10,000	20,000

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